

Farmington Bay Wetlands

Nutrient Criteria and Assessment Methods Development

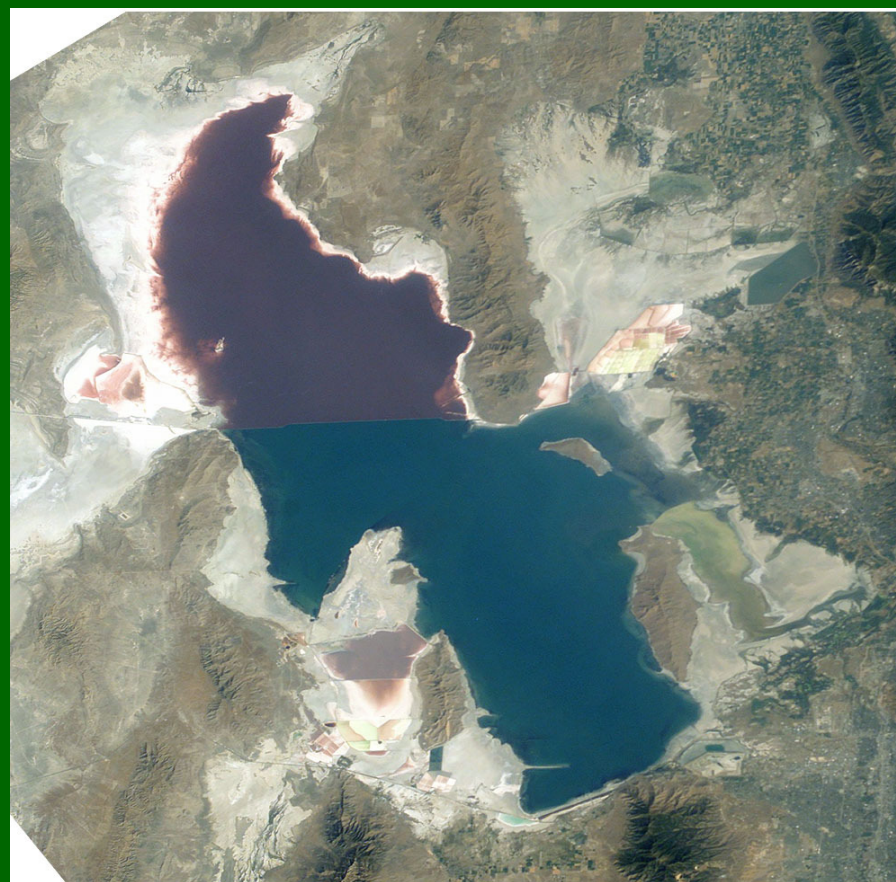
Wetlands and Ecosystem Services Workshop

September 26 & 27, 2007

**Theron Miller, Ph.D.
Utah Division of Water Quality**



1988



2003

Beneficial Uses of GSL

**Waterfowl and shorebirds,
aquatic life in their food chain**



**Important feeding and
nesting grounds for
migratory birds**

Aquatic Life



Brine Shrimp (*Artemia*)



***Artemia*
Cysts**

OBJECTIVE

DEVELOP METHODOLOGY FOR SITE-SPECIFIC NUTRIENT CRITERIA AND ASSOCIATED METHODOLOGY FOR BENEFICIAL USE ASSESSMENT

- **UNDERSTAND “HOW THE ECOSYSTEM WORKS”**
- **IDENTIFY SENSITIVE HABITAT, SEASON AND FOODCHAIN LINKS**
- **IDENTIFY (TOLERANCE) THRESHOLDS AMONG IMPORTANT ECOSYSTEM COMPONENTS**
- **INCORPORATE METRICS INTO AN INDEX OF BIOLOGICAL INTEGRITY**
 - **i.e. provide multiple lines of evidence for either supporting or impaired status**

Farmington Bay Wetlands Study

2004-2008

- Environmental Variables



- Water Quality: (Nutrients, pH, TDS, D.O., TSS, temperature).
- Soils: (pH, conductivity, nutrients, organic matter)

- Biotic Variables



- Plants: (percent cover, height, species composition, diversity, functional groups).
- Macroinvertebrates: (species composition, relative abundance, diversity, functional groups).
- Shorebirds: (nesting success, egg hatchability, foraging habitats)

Wetland Metrics Development

- What metrics are indicative of wetland condition?
- Are these metrics related to water quality?

FARMINGTON BAY WETLANDS PRINCIPAL INVESTIGATORS

- Heidi Hoven, Wetlands Scientist, Institute for Watershed Sciences
- John Cavitt, Ornithologist, Weber State University
- Sam Rushforth, Phycologist, Utah Valley State University
- Larry Gray, Entomologist, Utah Valley State University
- Sharook Madon, Wetlands Scientist, CH2MHill
- Dennis Wenger, Wetlands Scientist, Frontier Corporation

Shorebird Study Objectives

- Nesting habitat
- Nesting Success
- Hatching success



Shorebird Study Objectives, Cont'd

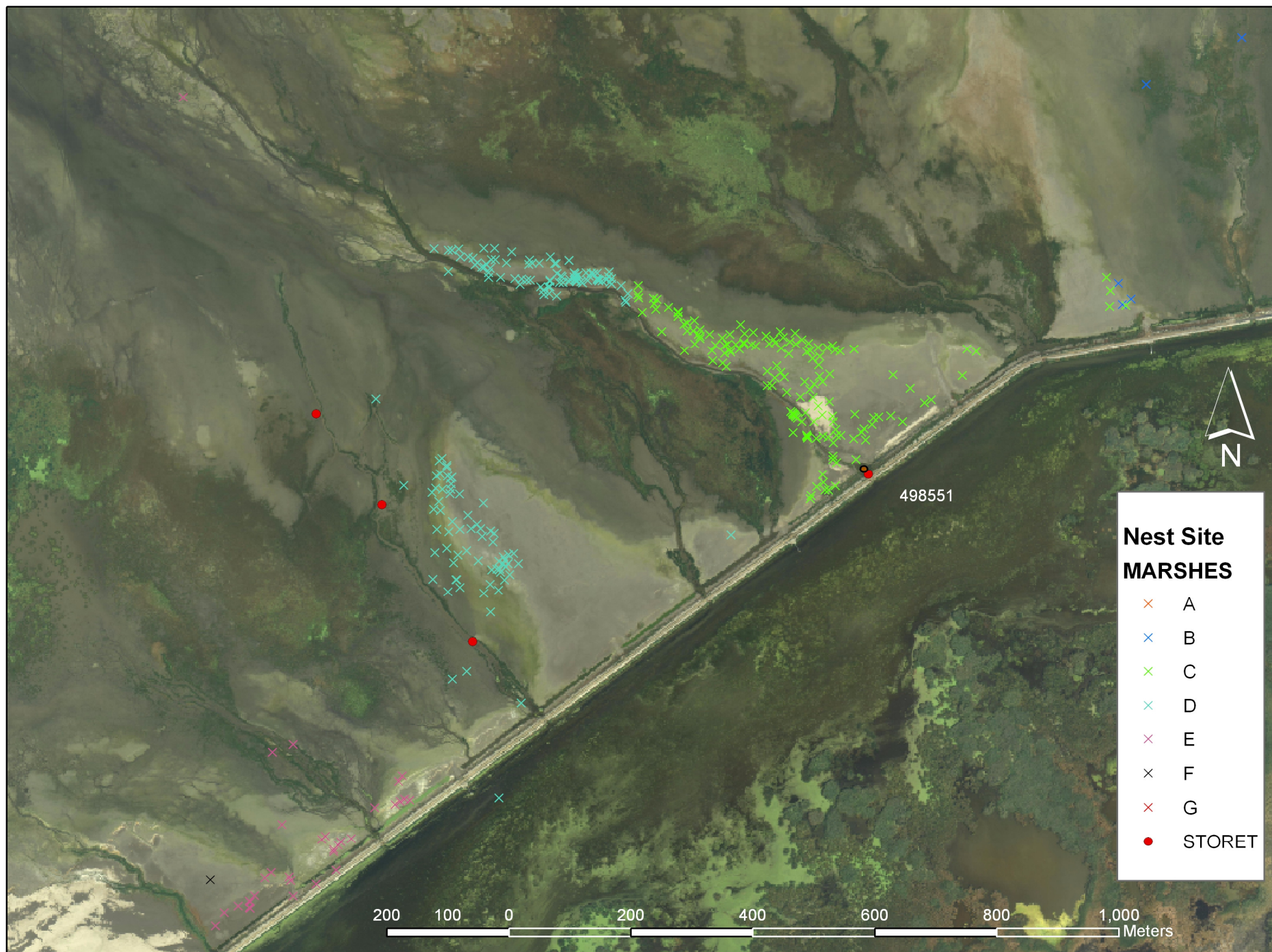
-Aquatic life in their food chain

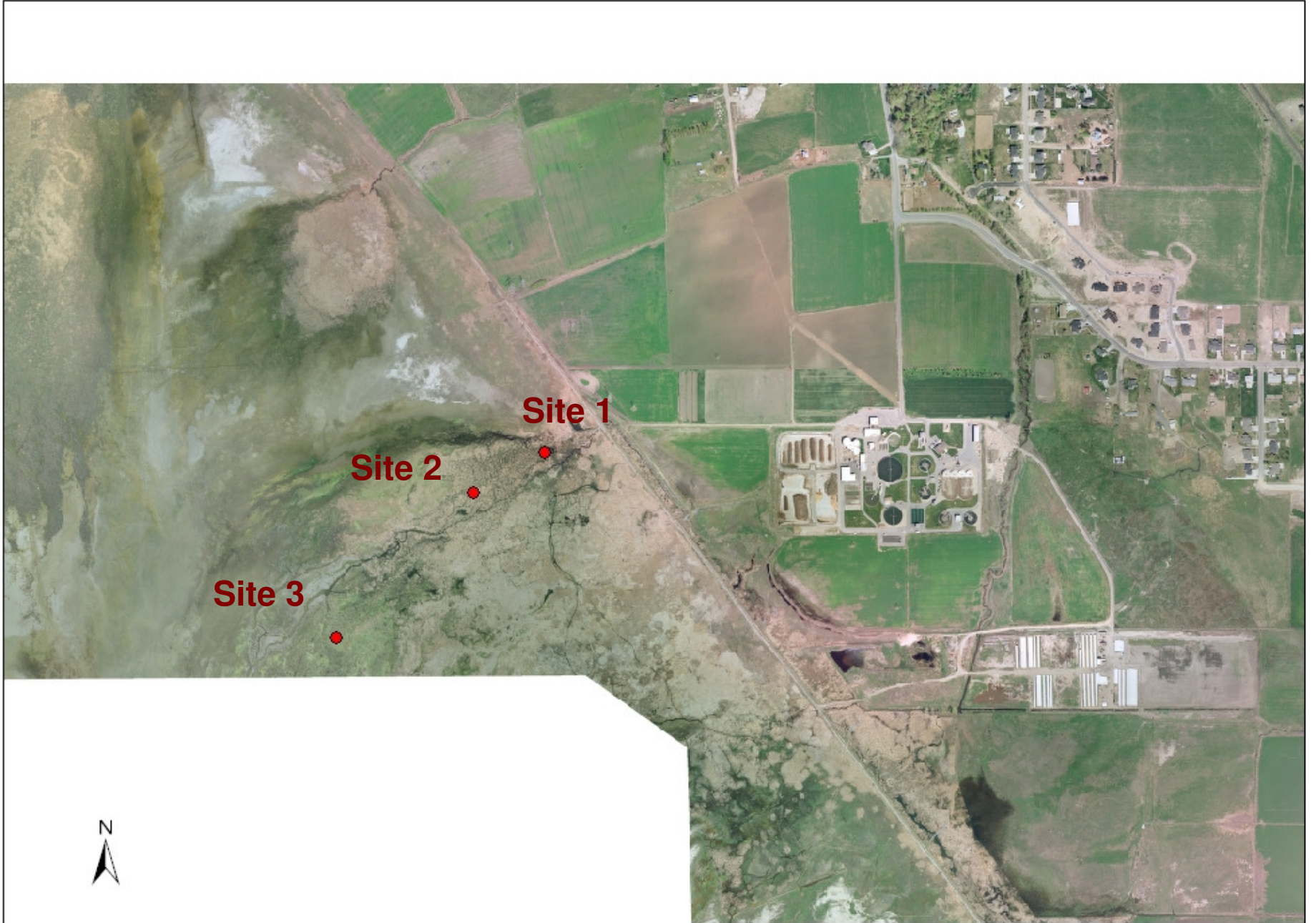


Midges



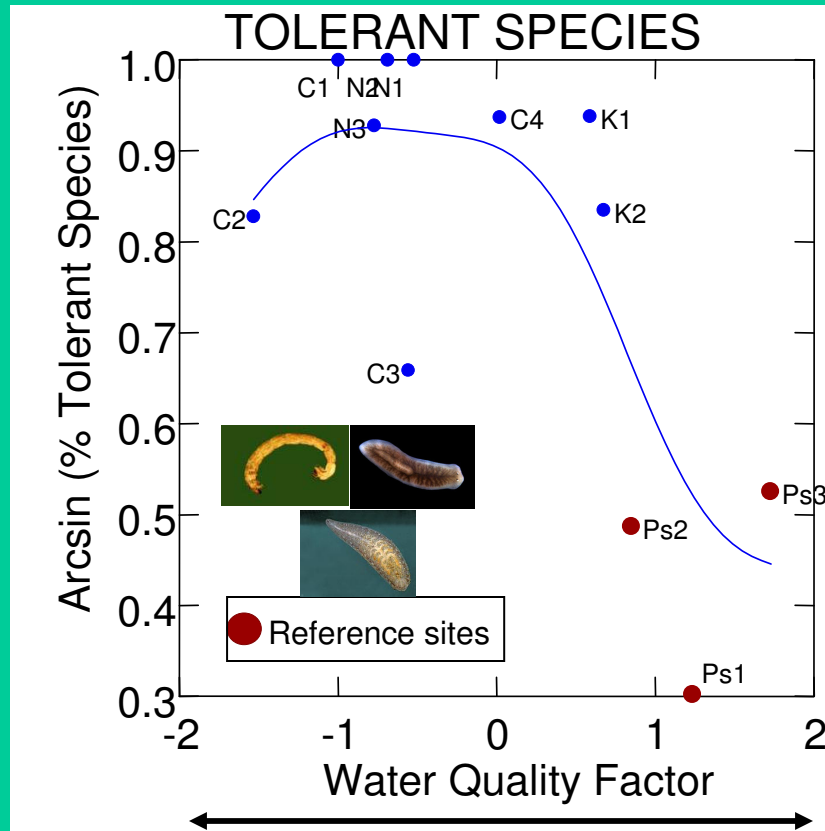
Corixidae





Tolerant & Sensitive Macroinvertebrates (2004)

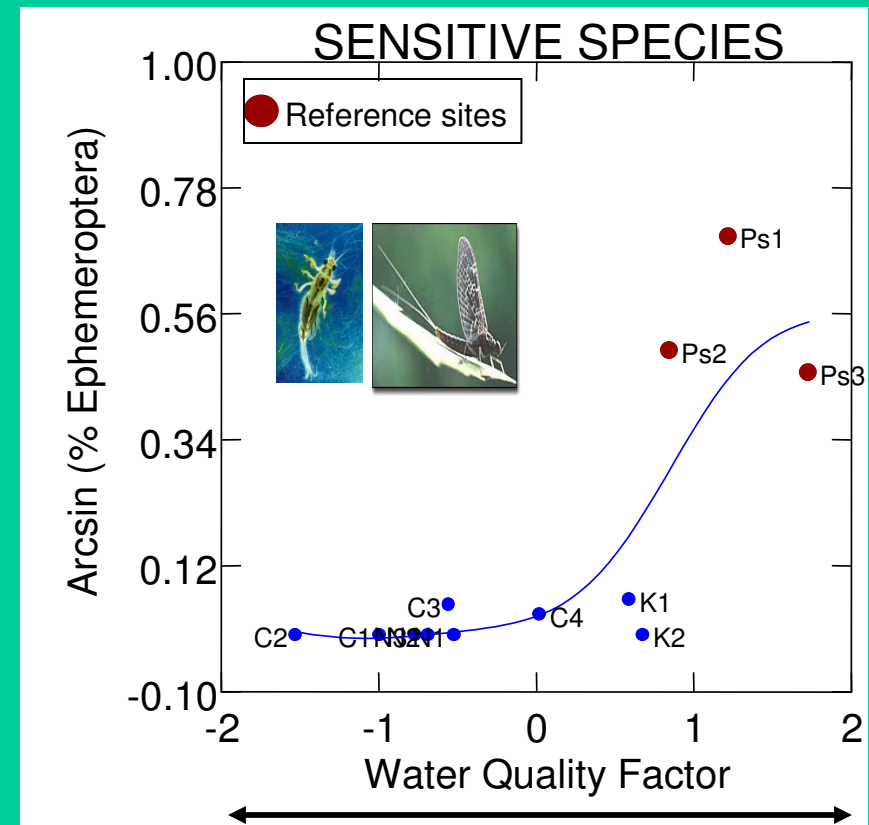
Sheetflow Sites



Increasing
Nutrients (Total
N and P)

Increasing pH,
Dissolved Oxygen
and TDS

Tolerant species were more abundant at eutrophic sites



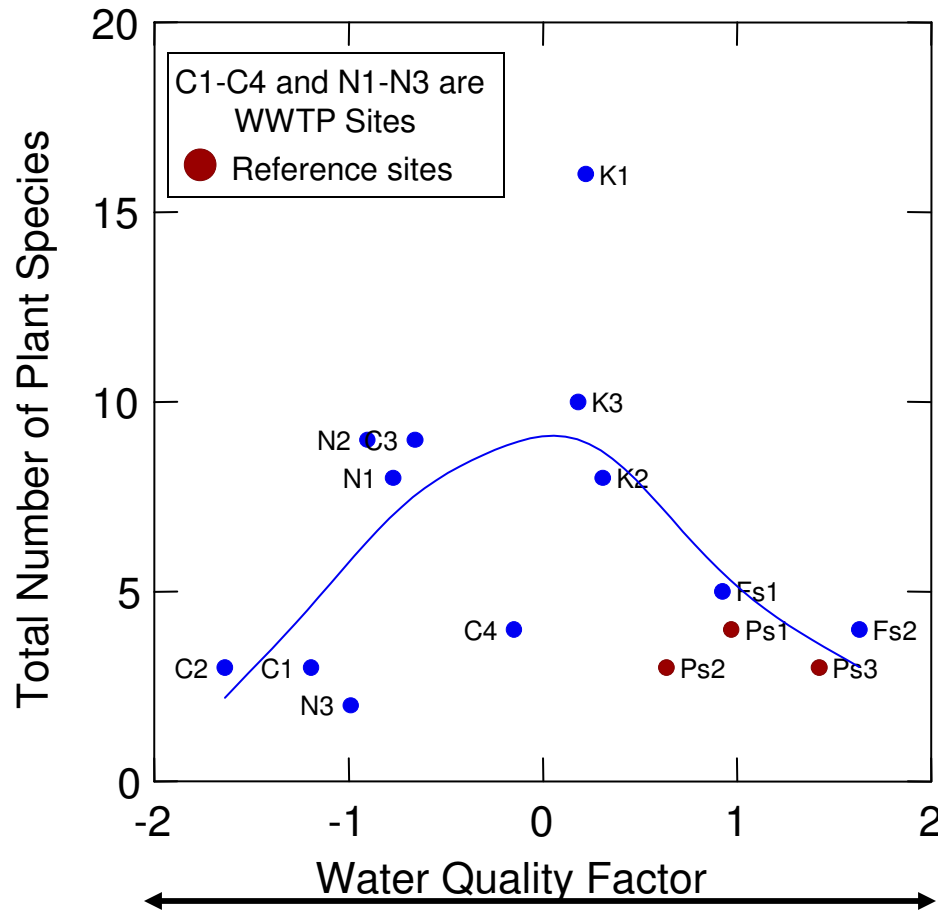
Increasing
Nutrients (Total
N and P)

Increasing pH,
Dissolved Oxygen
and TDS

Sensitive species were more abundant at oligotrophic sites, (e.g. reference sites)

Plant Species Diversity (2004)

Sheetflow Sites

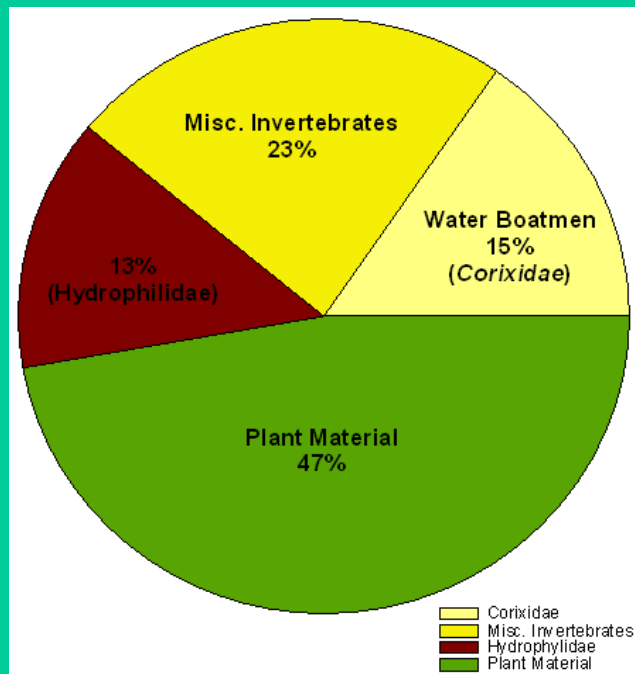


Plant diversity at some WWTP sites was higher than that observed at reference sites

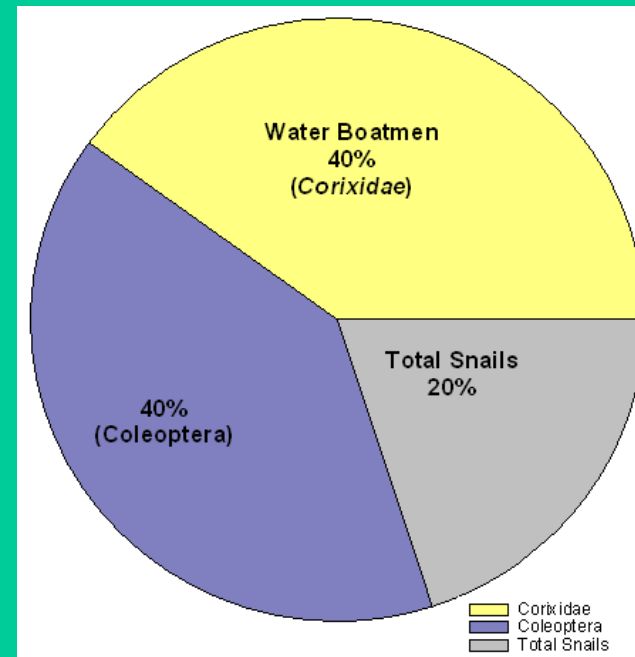
***Increasing Nutrients
(Total N and P)***

***Increasing pH, Dissolved
Oxygen and TDS***

Kays Creek (south)
Stomach contents by volume

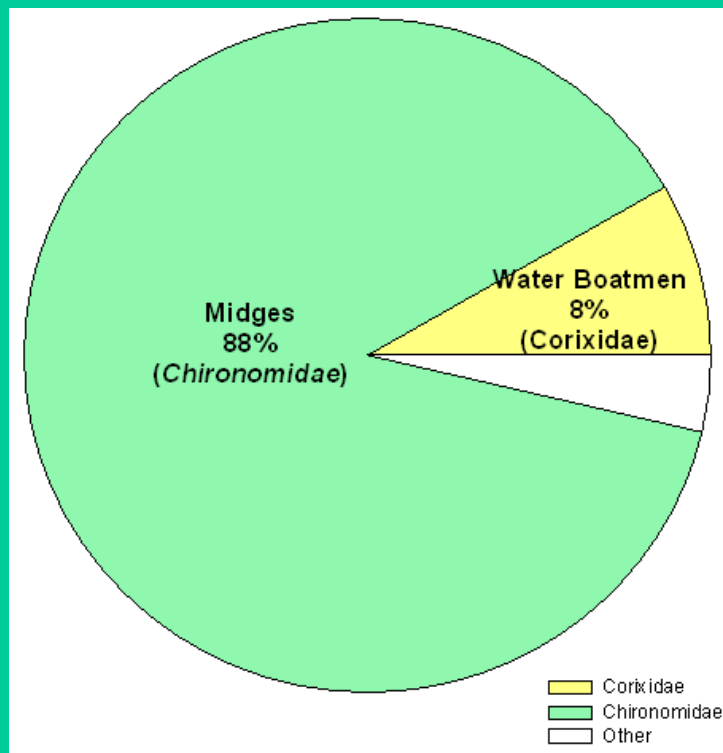


American avocet

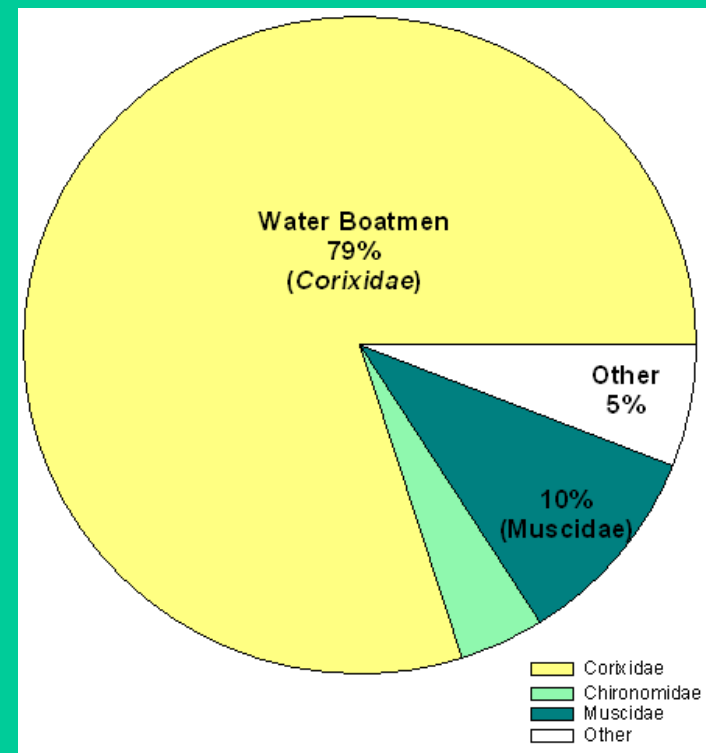


Black neck stilt

Bear River Bird Refuge Stomach contents by volume



American avocet



black neck stilt

Nesting and Hatching Success

Site	Year	Species	Total Eggs Laid (total nests)	Clutch Size (n)	Hatchability (n)	Total Young Produced (average # eggs hatched / nest)	# Young Leaving/Nest (n)
FARM	2005						
		AMAV	1681 (481)	3.86 ± 0.51 (247)	0.96 ± 0.13 (247)	914 (1.9)	3.75 ± 0.57 (247)
		BNST	769 (411)	3.87 ± 0.48 (201)	0.97 ± 0.11 (201)	737 (1.79)	3.76 ± 0.62 (201)
	2006						
		AMAV	2146 (641)	3.93 ± 0.30 (413)	0.93 ± 0.15 (369)	1538 (2.4)	3.55 ± (435)
		BNST	1123 (313)	3.97 ± 0.21 (232)	0.96 ± 0.12 (221)	916 (2.9)	3.77 ± (243)

Impoundments 2004 Conclusion

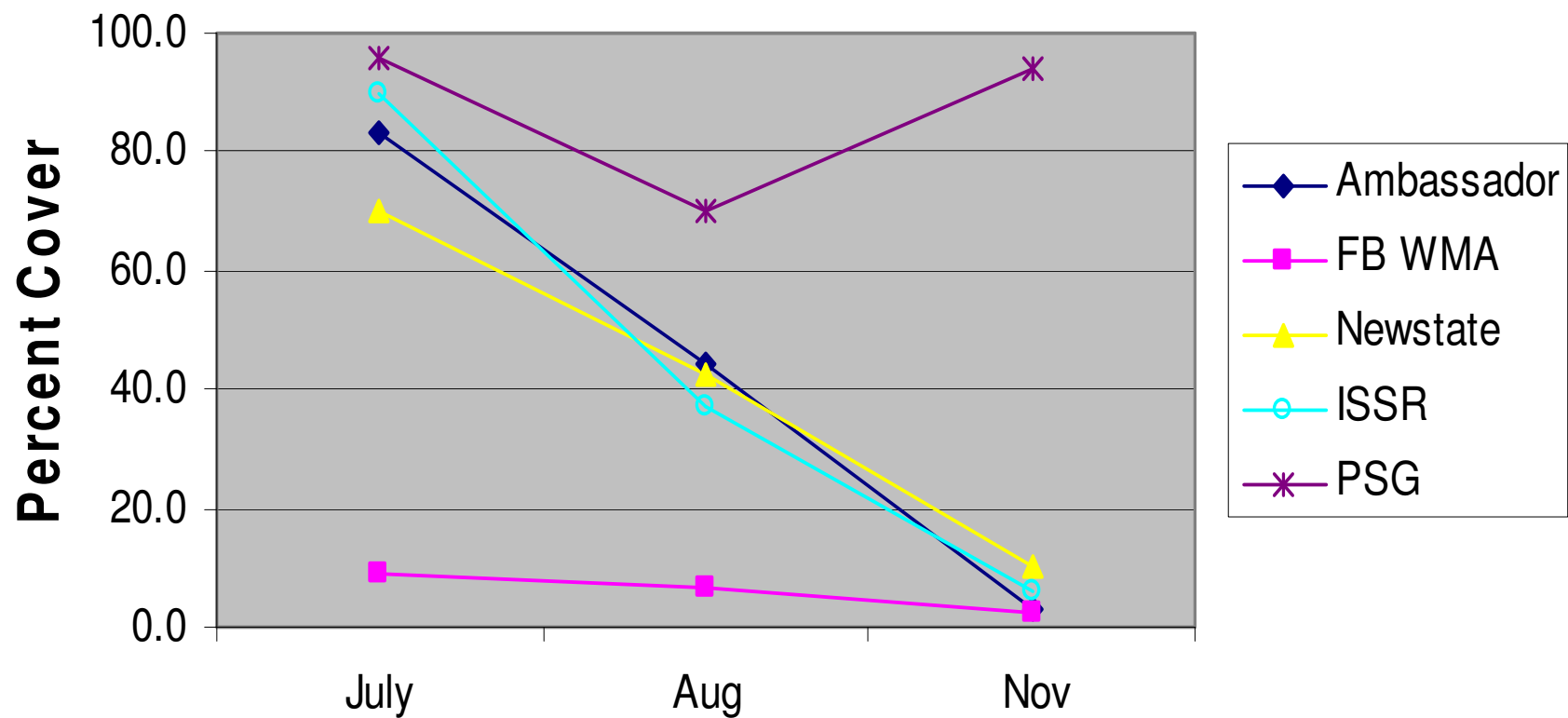


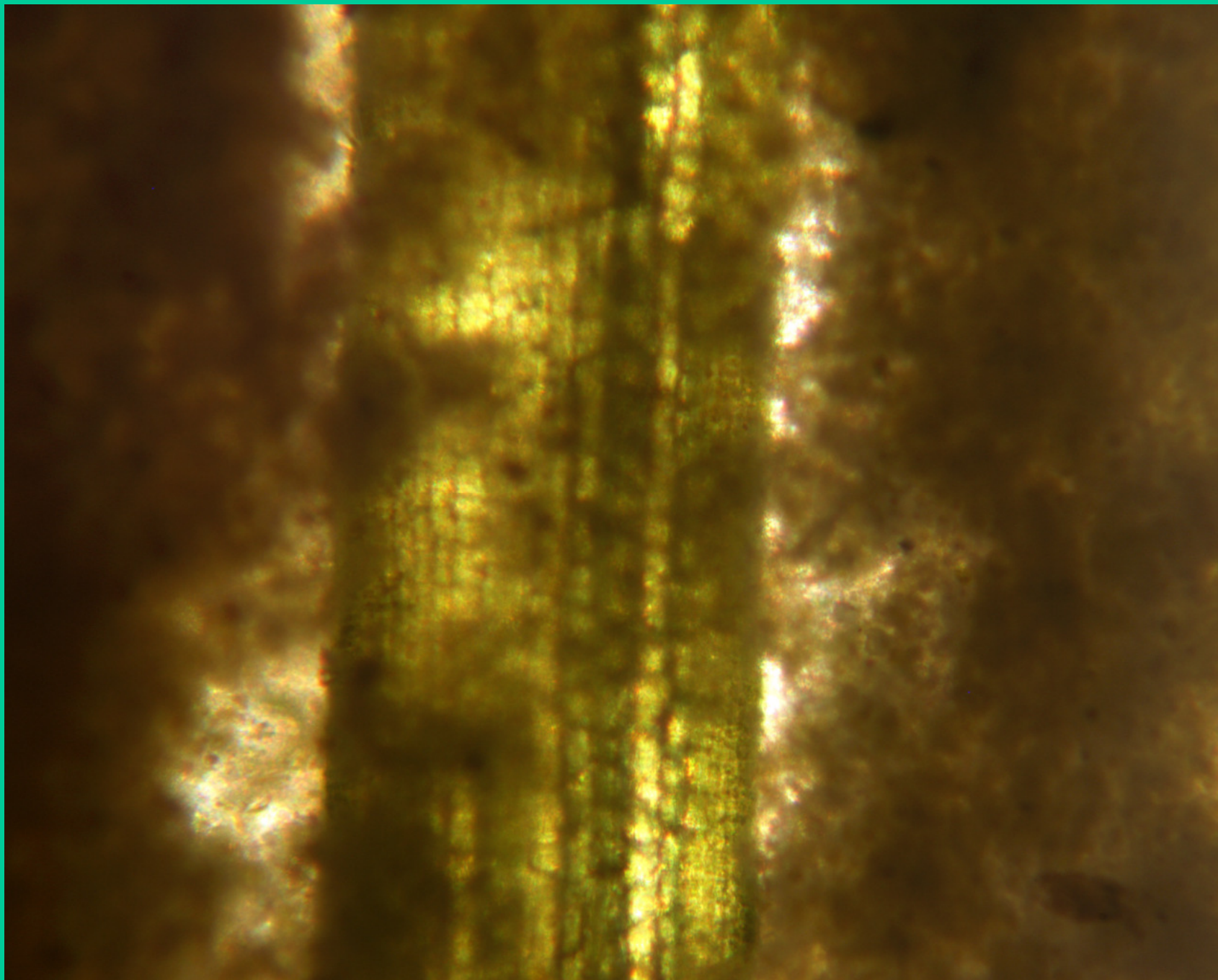
- Analytical method shows general trends and relationships, however, we need a more sensitive tool to make the link between ecological function and beneficial use.



Seasonal Percent Cover

a) Upper Pond





Potential Metrics for an IBI

- Macroinvertebrate species composition and density (during nesting season and fall migration season).
- Percent of Ephemeroptera
- Percent of Chironomidae
- Percent odonates or clingers
- Percent exotic and/or invasive plants
- Submerged aquatic vegetation above ground biomass
- SAV percent coverage
- C:N:P ratios in phytoplankton and macrophytes
- Chlorophyll a / macrophyte fluorescence
- turbidity/ light penetration
- Presence/composition of floating vegetation
- Summer mean diel DO
- Diel minimum DO

Remaining Data Gaps

- Determine relative importance of shading, waterfowl foraging, carp foraging and potential stress from excess P in the impoundments.
- Quantify nesting habitat characteristics in terms of plant communities and proximity to water.
- Quantify shorebird juvenile survivability and link this to habitat and food resource requirements.